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(54) Refrigerating trailers

A temperature control unit for a trailer includes a plurality evaporator coils 41, 42, 43 locatable in the interior of a trailer 10. Each coil 41, 42, 43 is connected to a different compressor 31, 32, 33 . A thermostat 41', 42', 43' is associated with each coil 41, 42, 43, in the interior of the trailer, each thermostat being connected to an associated compressor, and being capable of actuation and de-actuation of same. An electric generator 21 for powering the compressors is provided, and an int rnal combustion engine 20 for driving the generator, said engine, generator and compressors being housed in a single unit mountable on the outside of a said trailer.

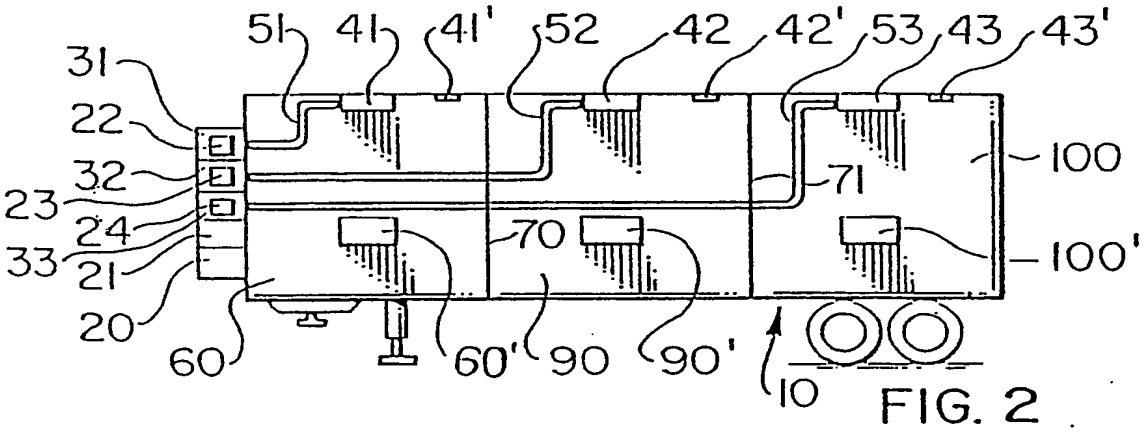

FIG. 2

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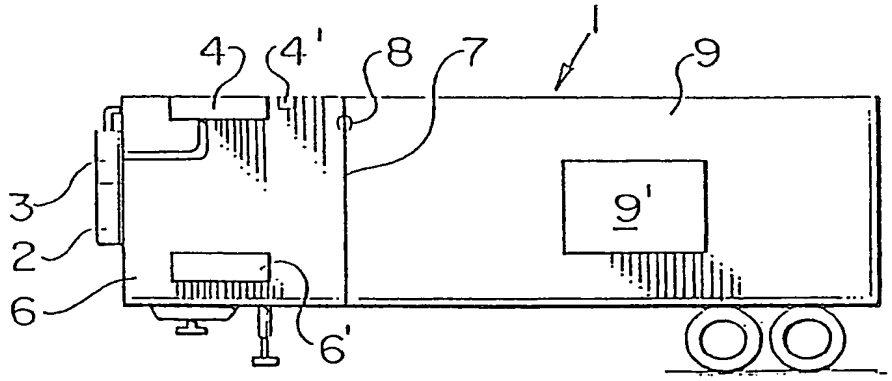

FIG. 1
(PRIOR ART)

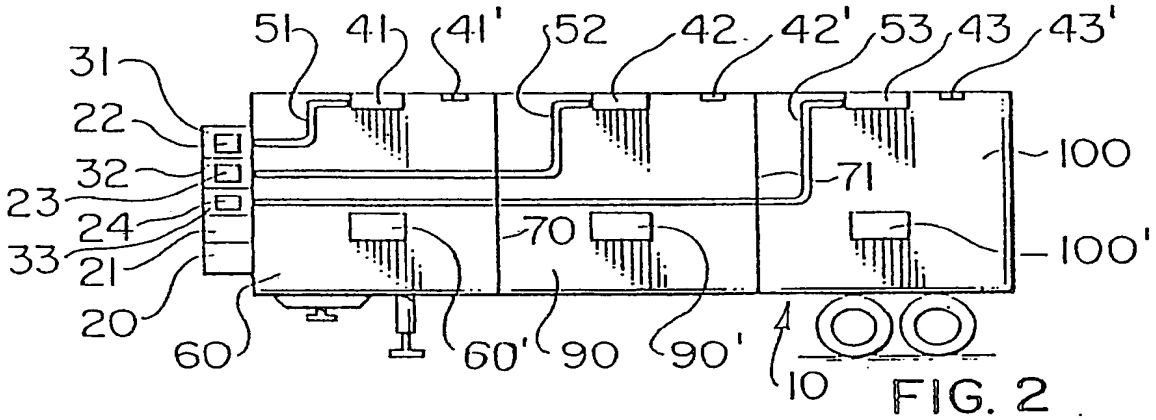

FIG. 2

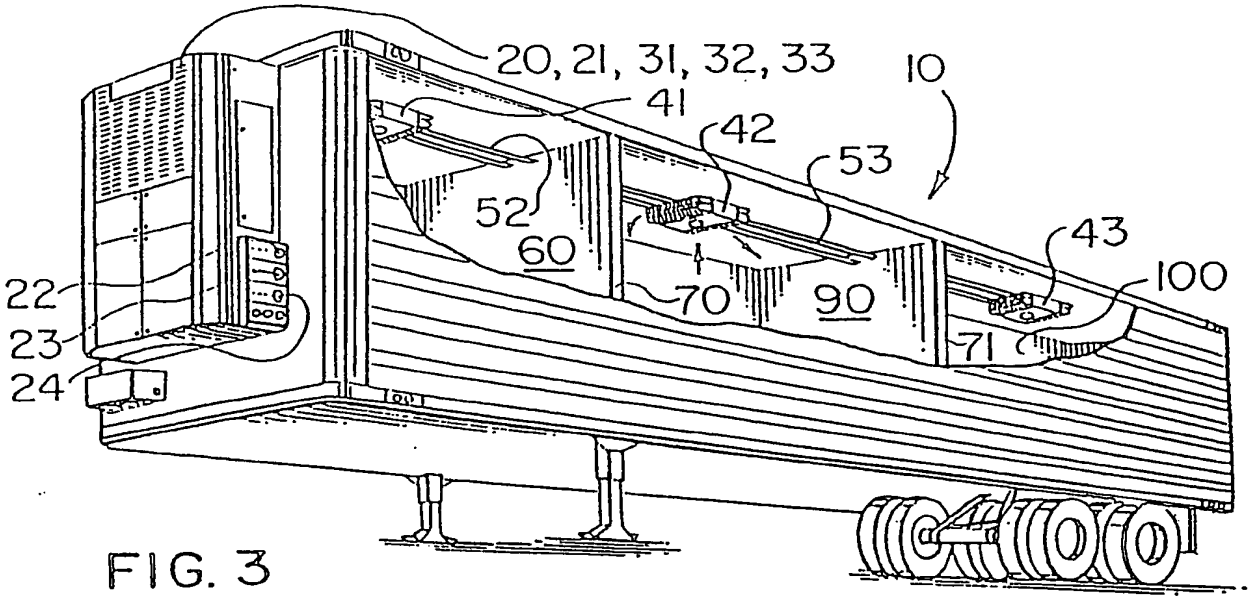

FIG. 3

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REFRIGERATION UNIT

The present invention relates to the field of transportation of goods. More particularly, the present invention relates to the transportation of goods by temperature controlled truck or trailer, and to a refrigeration/temperature control unit for a tractor driven trailer or a truck.

To transport frozen foods such as ice cream, and perishable goods such as vegetables, from their place of manufacture or production to market, the food industry relies heavily upon refrigerated trucks and trailers.

There are basically two situations which can arise when transporting a load of food in a refrigerated trailer (or, as will be apparent, truck - truck and trailer being used interchangably herein):

i) the entire load is similar in nature, so that it all requires to be transported at the same temperature; or

ii) several different products are being transported in a single trailer, and the products need to be transported at different temperatures.

Now, in the first situation, no significant problem will arise utilizing known refrigerated trailers. These trailers provide a refrigerated trailer interior which is

insulated from the external environment. The interior of the trailer is cooled by means of evaporator coils in which circulate a refrigerant, pumped by a compressor which is powered by an engine on the exterior of the trailer. A thermostatic sensor is located in the return air of the cooling system, within the interior of the trailer. Accordingly, as long as the refrigerated air is well distributed within the interior of the trailer, a reasonably constant temperature is maintainable in the trailer.

The problem with known trailers, and maintenance of a constant temperature therein, arises when one considers the second situation described above. If, say, ice cream and milk are being transported from a dairy to a community a large distance away, it is very important that the ice cream be kept frozen, and that the milk be kept cool, but not frozen. It is apparent, therefore, that the above described idealized trailer, with well distributed refrigeration coils will be inappropriate for the transportation of goods at two such diverse temperatures. A compromise solution has therefore emerged in refrigeration trailer design. Refrigeration (i.e. evaporator) coils are usually located in only one end of the trailer. This will suffice to keep the interior of the trailer at a fairly constant temperature, bearing in mind that the region of the interior of the trailer (which is often quite voluminous) nearest the coils will be somewhat colder than the region remote from the coils. Fans, to circulate air within the trailer can be

installed as a partial solution, but fans will have very limited effect when the interior of the trailer is filled with produce.

Having the coils at one end of the trailer does assist in the transportation of two different sorts of goods, like ice cream and milk. The ice cream (i.e. the colder product) will be packed into the end of the trailer containing the refrigeration coils. An insulating barrier or temporary wall is then erected. The milk (i.e. the less cold product) is then loaded in against the barrier. Some air flow past the barrier is permitted, so that the milk is also kept chilled. It is clear, though, that this means of transporting two (or more) sorts of goods has some serious drawbacks. Temperature control in the less cold compartment is virtually non-existent, and the temperature therein will certainly not be constant. The temperature near the points of permitted air-flow from the colder compartment will be very low; low enough to irreparably damage some products, like lettuce or tomatoes. On the other hand, the temperature at the remote end of the trailer will often be unacceptably high, causing spoilage of many sorts of fresh produce. All of the foregoing problems with current refrigerated trailers are exacerbated by the fact that insulation in trailers (or anything) is by no means perfect. This, combined with the fact that one of the prime utilizations of refrigerated trailers is to transport goods from very hot climates a long distance to very cold climates, means that very often there

is unacceptable spoilage within the trailer.

There has recently been introduced in the refrigerated trailer market a refrigeration system for a trailer which attempts to solve the problems associated with the prior art as aforesaid. This recent refrigeration system provides a main refrigeration coil at one end of a trailer, and a number of auxilliary refrigeration coils are provided as branches from the main coil. The auxilliary coils are located in compartments in a trailer. Such an arrangement does provide for better maintenance of coolness in the compartments containing the auxilliary coils, but as before, no control. The thermostat, being located in the forward compartment with the main coil, will be insensitive to temperature fluctuations within the secondary compartments. Moreover, it is not feasible to provide each compartment in such a system with a thermostat with control over the compressor to cause the compressor to turn off upon reaching a set temperature in any compartment because this would adversely affect the other compartment or compartments. Furthermore, it will be noted that in such a system, a break down of the system will affect all compartments, rather than just the one where the breakdown is located.

To the best of the Applicant's knowledge and information, no trailer refrigeration system has ever been provided with more than one compressor. Therefore, shut-down and start up of the refrigeration system in any known trailer

will affect the entire contents of the trailer, regardless of whether or not this is desired. Moreover, the Applicant is not aware of any trailer refrigeration system making use of a generator powered by an internal combustion engine to run one or more compressors, and to run a heater for the fast and efficient defrosting of the refrigeration systems.

The object of the present invention is to provide a temperature control unit trailer or truck which overcomes the drawbacks associated with known refrigerated trailers and trucks. A further object of the present invention is to provide a refrigerated trailer or truck in which fairly precise temperature control in more than one range is possible.

In one broad aspect, the present invention relates to a temperature control unit for a trailer including: at least one evaporator coil locatable in the interior of said trailer, each coil being connected to a compressor on the outside of said trailer; and a thermostat associated with each said coil, in the interior of said trailer, each said thermostat being connected to an associated compressor, and being capable of actuation and de-actuation of same, an electric generator for powering said compressor, and an internal combustion engine for driving said generator, said engine, generator and compbessors being housed in a single unit mountable on the outside of a said trailer.

In drawings which illustrate the present invention by way of example:

Figure 1 is a schematic side view diagram of a typical prior art refrigerated trailer;

Figure 2 is a schematic side view diagram of a trailer embodying the present invention, with two interior compartments; and

Figure 3 is a lower front corner perspective view, partially cut away, of a trailer embodying the present invention with three interior compartments.

Referring first to Figure 1, a typical refrigerated trailer 1 of known design is shown loaded with two different products: one 6' such as ice cream which must be kept frozen, and one 9' such as milk which ought not to be frozen, but should be kept cold. The trailer 1 is provided with a motor 2, such as a gasoline motor, which drives a compressor unit 3 mounted adjacent it on the body of the trailer. The compressor is thermal-electrically linked to a thermostat 4' in the cold section 6 of the interior of the trailer 1. Evaporator coils 4 are located within the cold section 6, the coils being linked to the compressor 3 by refrigerant flow lines 5. It will be understood, then, that compressor 3 by causing a flow of evaporated refrigerant through the coils 4 cools the cold section 6 to the temperature set at the thermostat. A thermally insulating barrier 7 separates the cold section 6 from the less cold section 9 of the trailer. Ventilation

holes 8 in the barrier 7 permit a flow of cold air into the less cold section 9, to cool the products loaded in there. It will be clear that there is no way of maintaining the temperature in the less cold section at a constant desired level.

Referring next to Figures 2 and 3, it will be seen that the Applicant provides a system wherein a trailer 10 is provided with more than one refrigeration coil 41, 42, 43, each one being located in a section 60, 90, 100 of the trailer 10 so that the food 60', 90', 100' in each section can be kept at a desired temperature without regard to the temperature at which the food in the rest of the trailer is being kept. Refrigerant lines 51, 52, 53 connect the coils to a plurality of compressors 31, 32, 33, one corresponding to each section 60, 90, 100. In each section there is a thermostat 41', 42', 43', which is thermal electrically connected to a compressor 31, 32, 33. Preferably, semi-hermetic electric compressors are provided. The compressors 31, 32, 33 are driven by a generator 21, which is powered by an engine 20, which may be gas or diesel. It is necessary to provide a condensor (not illustrated - but present in prior art) in connection with the compressors. Also, a plurality of temperature setting controls 22, 23, 24 are provided to set, independently, the temperature in each section of the trailer. Moreover, it will be understood that all other refrigeration equipment, as required, and as will be obvious to one skilled in the art,

will be provided for the operation of the system of the present invention.

The sections 60, 90, 100 of the trailer are separated by walls 70, 71. It will be understood that it is preferred that, walls 70, 71 will be movable to vary the size of the sections 60, 90, 100, and removable, if it is desired to have the entire trailer cooled to the same temperature. Also, each section 60, 90, 100 will preferably be provided with its own set of access doors, so that one can load or unload food from a section without affecting the food in another section.

It is to be understood that the examples described above are not meant to limit the scope of the present invention. It is expected that numerous variants will be obvious to the person skilled in the field of refrigerated food transportation, without any departure from the spirit of the present invention. The appended claims, properly construed, form the only limitation upon the scope of the present invention.

CLAIMS

1. A temperature control unit for a trailer including: at least one evaporator coil locatable in the interior of said trailer, each coil being connected to a compressor on the outside of said trailer; and a thermostat associated with each said coil, in the interior of said trailer, each said thermostat being connected to an associated compressor, and being capable of actuation and de-actuation of same, an electric generator for powering said compressor, and an internal combustion engine for driving said generator, said engine, generator and compressors being housed in a single unit mountable on the outside of a said trailer.

2. A temperature control unit as described in Claim 1, further including a temperature setting control associated with each said compressor, for setting the desired temperature in the interior of said trailer where said coil is located.

3. A temperature control unit as claimed in Claim 2, including two said coils, each located in a separate compartment in said trailer and each being capable of maintaining the temperature in its said compartment at a desired temperature without regard to the temperature in the other said compartment, there being two said compressors, one for each said coil, which are electrically powered by said generator and which are part of said unit.

4. A temperature control unit as claimed in Claim 2, including three said coils, each located in a separate compartment in said trailer and each being capable of maintaining the temperature in its said compartment at a desired temperature without regard to the temperature in the other said compartments, there being three said compressors, one for each said coil, which are electrically powered by said generator and which are part of said unit.

5. A temperature control unit as claimed in Claim 2, including four said coils, each located in a separate compartment in said trailer and each being capable of maintaining the temperature in its said compartment at a desired temperature without regard to the temperature in the other said compartments, there being three said compressors, one for each said coil, which are electrically powered by said generator and which are part of said unit.

6. A temperature control unit as claimed in Claim 3, 4 or 5, wherein there is provided in association with said unit a single condensor divided into sections, one section corresponding to each compressor.

7. A unit as claimed in Claim 3, 4 or 5, wherein each evaporator coil is provided with an electric heating element powered by said generator for defrosting said coil or for acting as a heat source for the interior of a trailer.

8. A temperature control unit substantially as hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.

9. A trailer provided with a temperature control unit according to any preceding claim.